United States Patent [19]

Nowacki

[11] **4,217,815**

[45] **Aug. 19, 1980**

[54] **MACHINE FOR ERECTING STRAWBERRY LUG**

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[73] Assignee: **International Paper Company**, New York, N.Y.

[21] Appl. No.: **953,703**

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[51] **Int. Cl.**[3] **B31B 1/26**

[52] **U.S. Cl.** ..... **93/37 R**; 93/49 R; 93/49 M

[58] **Field of Search** ..... 93/37 R, 51 HW, 37 SP, 93/51 R, 36.3, 51 M, 49 M, 37 EC, 49 R; 229/27

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Primary Examiner—Robert Louis Spruill
Assistant Examiner—K. Y. Lin
Attorney, Agent, or Firm—Stephen P. Gilbert

[57] **ABSTRACT**

Method and apparatus for forming a tray are disclosed. The tray has at least one transverse hollow wall formed by a pair of substantially parallel, spaced flaps that are folded down from a transverse bridge. Each flap is secured to a tab folded upwards from the bottom of the tray. A pair of pivotally-mounted folding arms located above the tray rotate the two flaps downwardly while a mandrel located beneath the tray forces the two tabs upwardly into a substantially parallel, spaced relationship, whereby each tab contacts and becomes secured to its respective flap.

12 Claims, 15 Drawing Figures

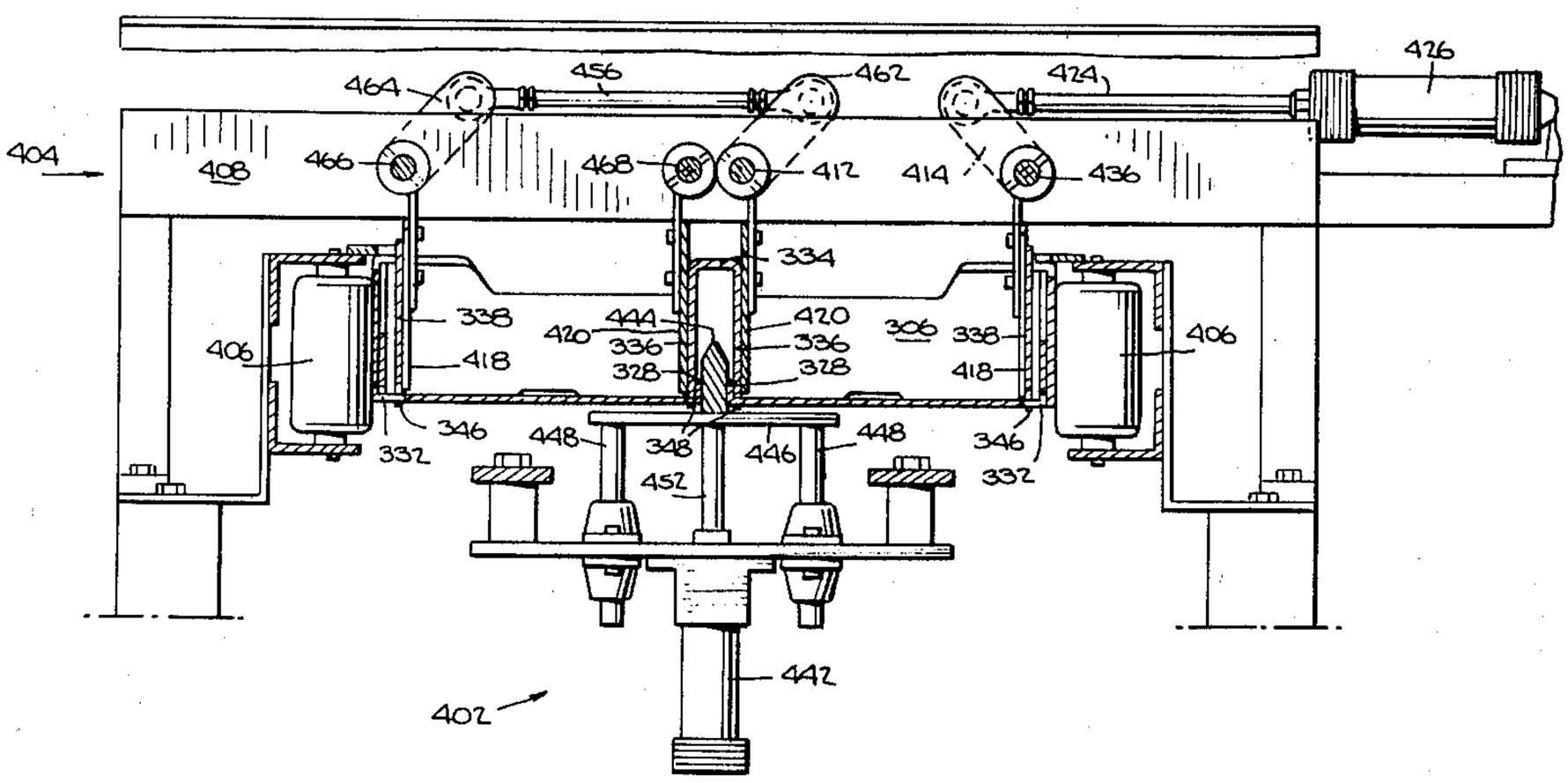

Fig. 1.

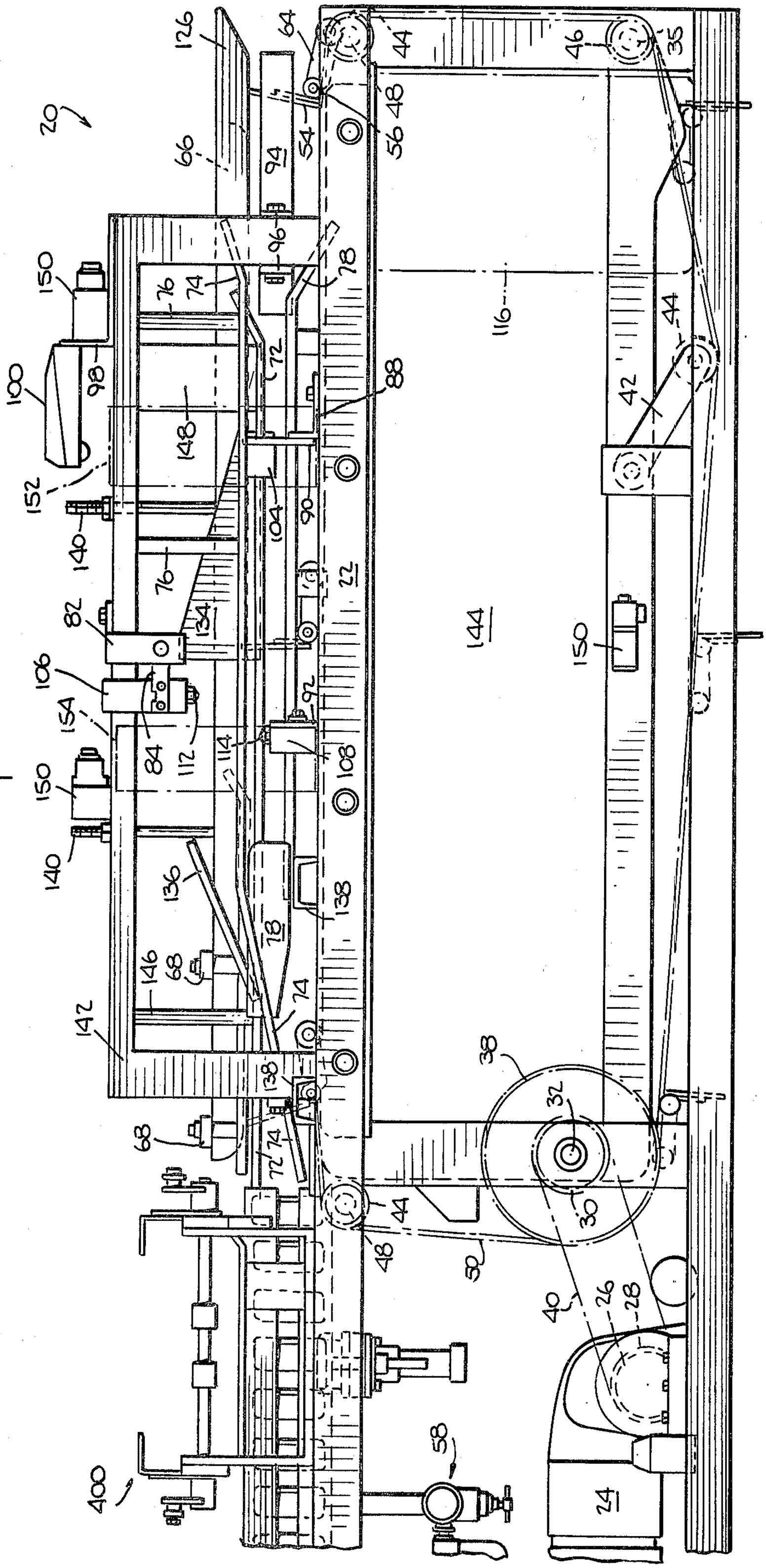
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Fig. 2.

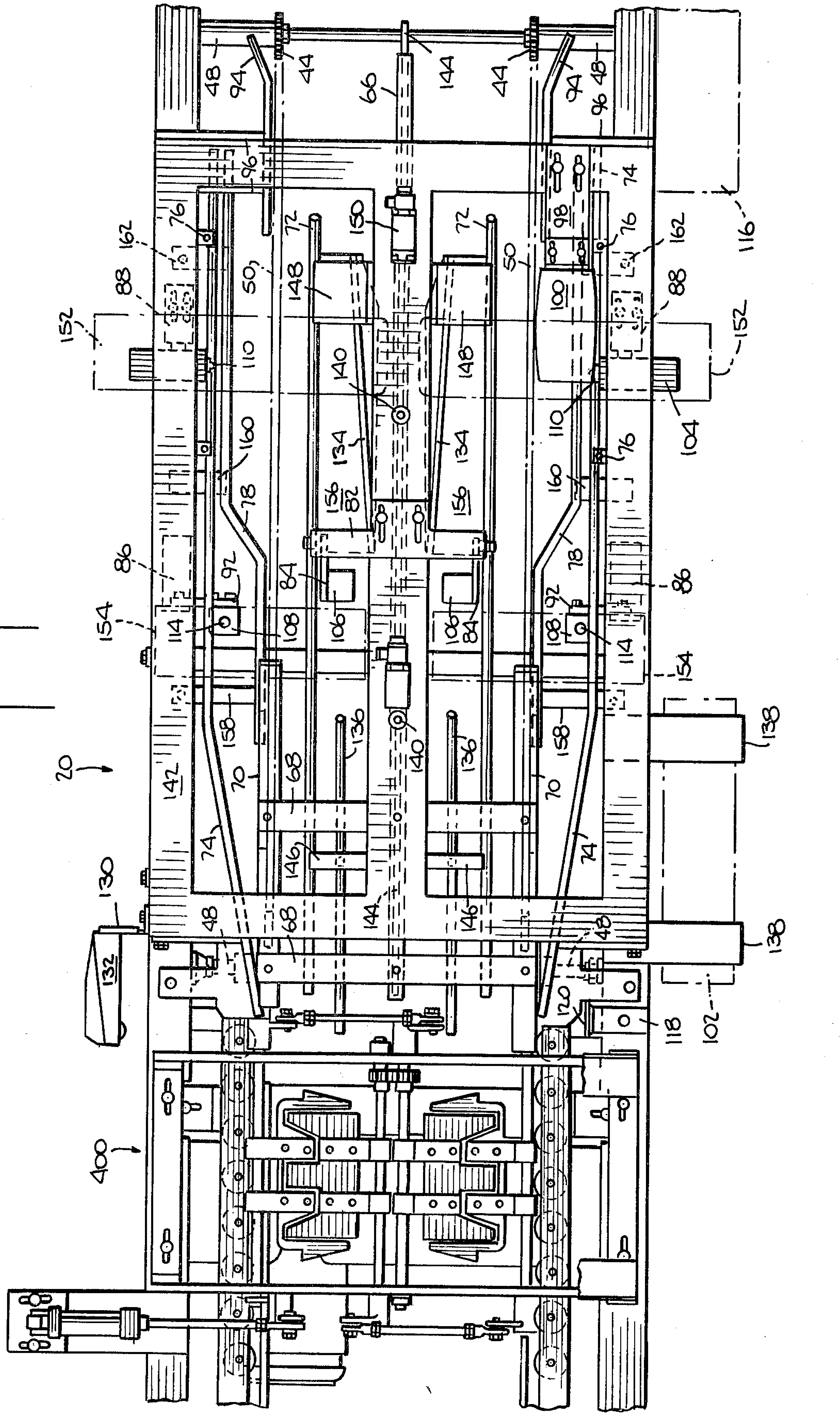
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Fig. 3.

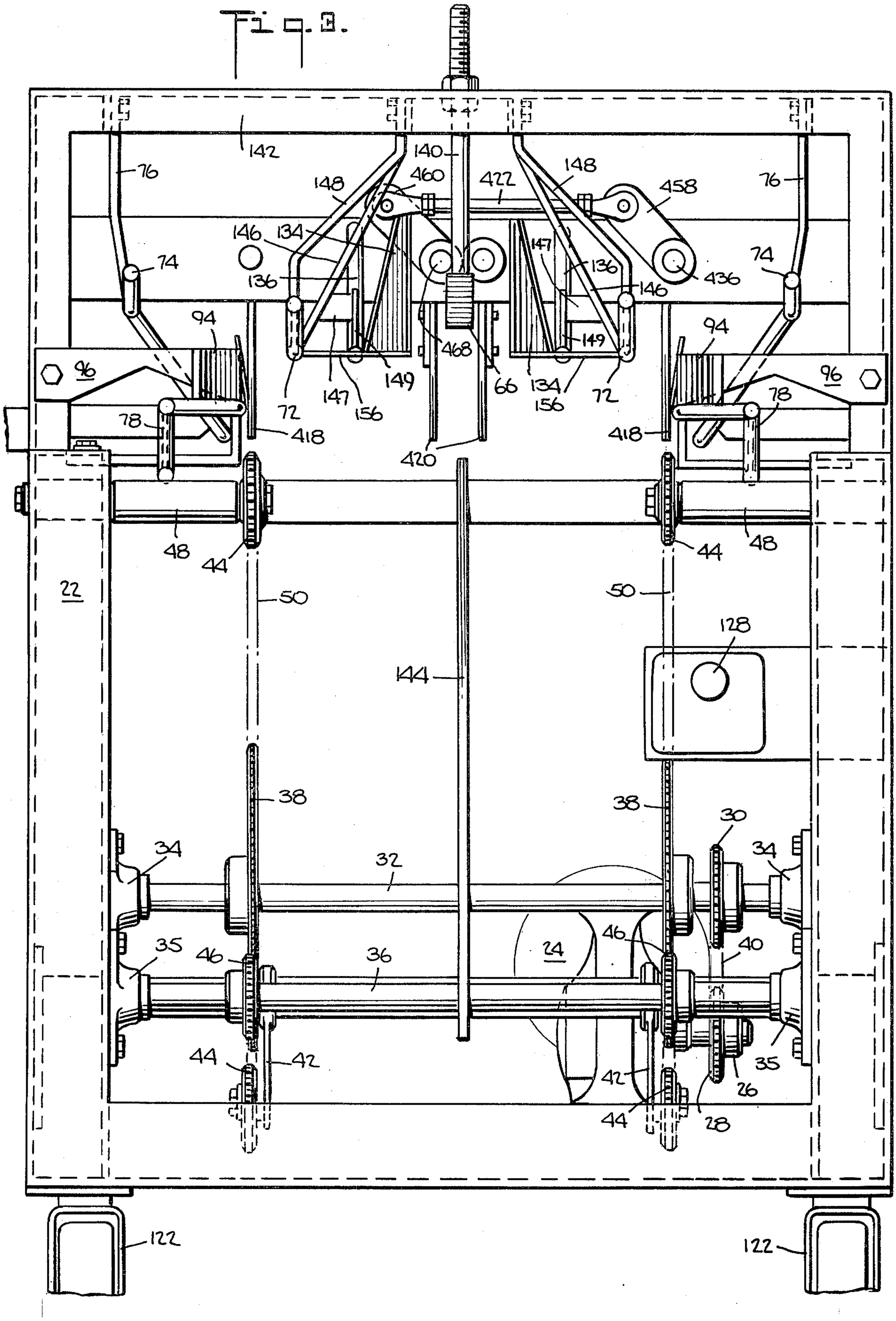
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Fig. 4.

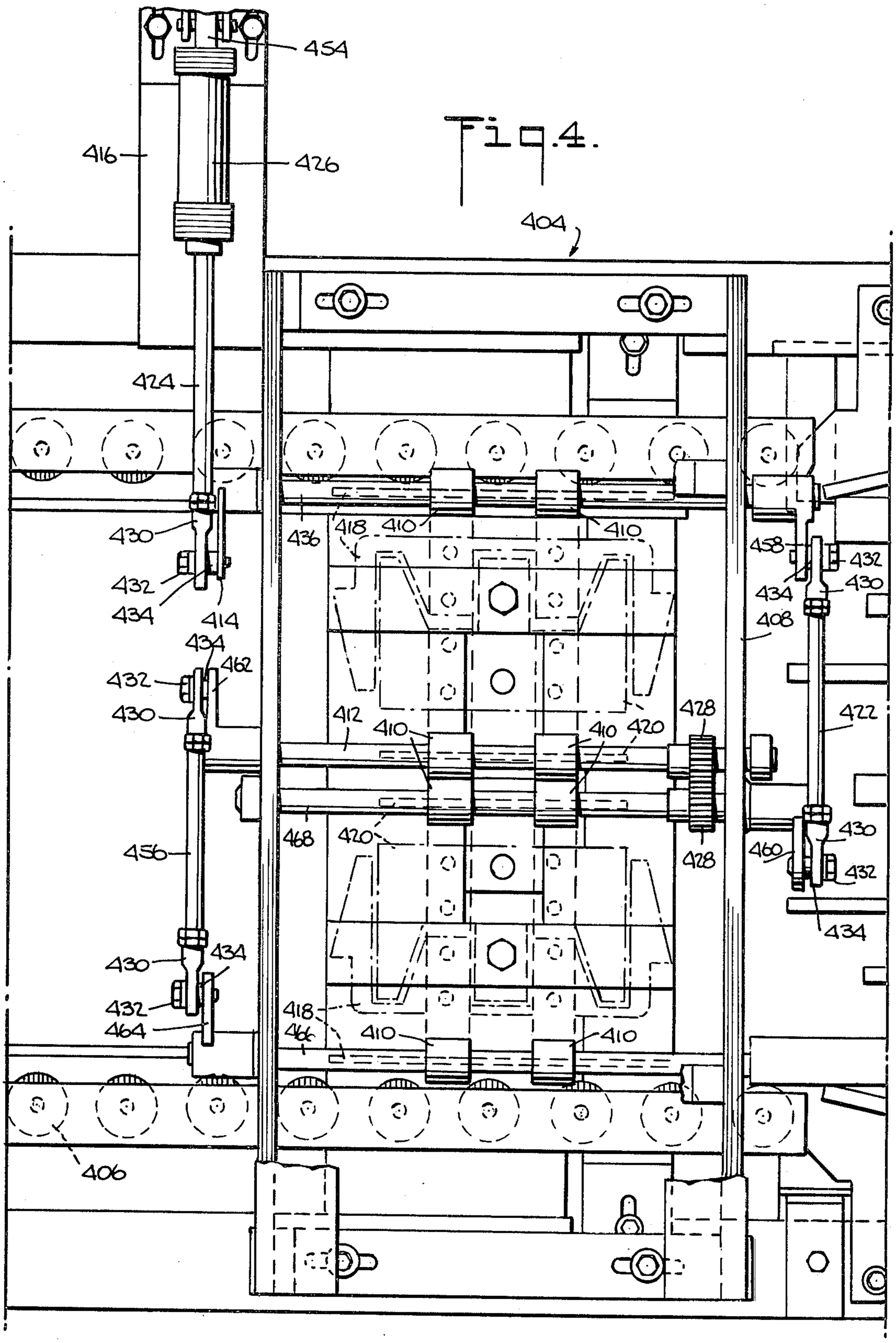
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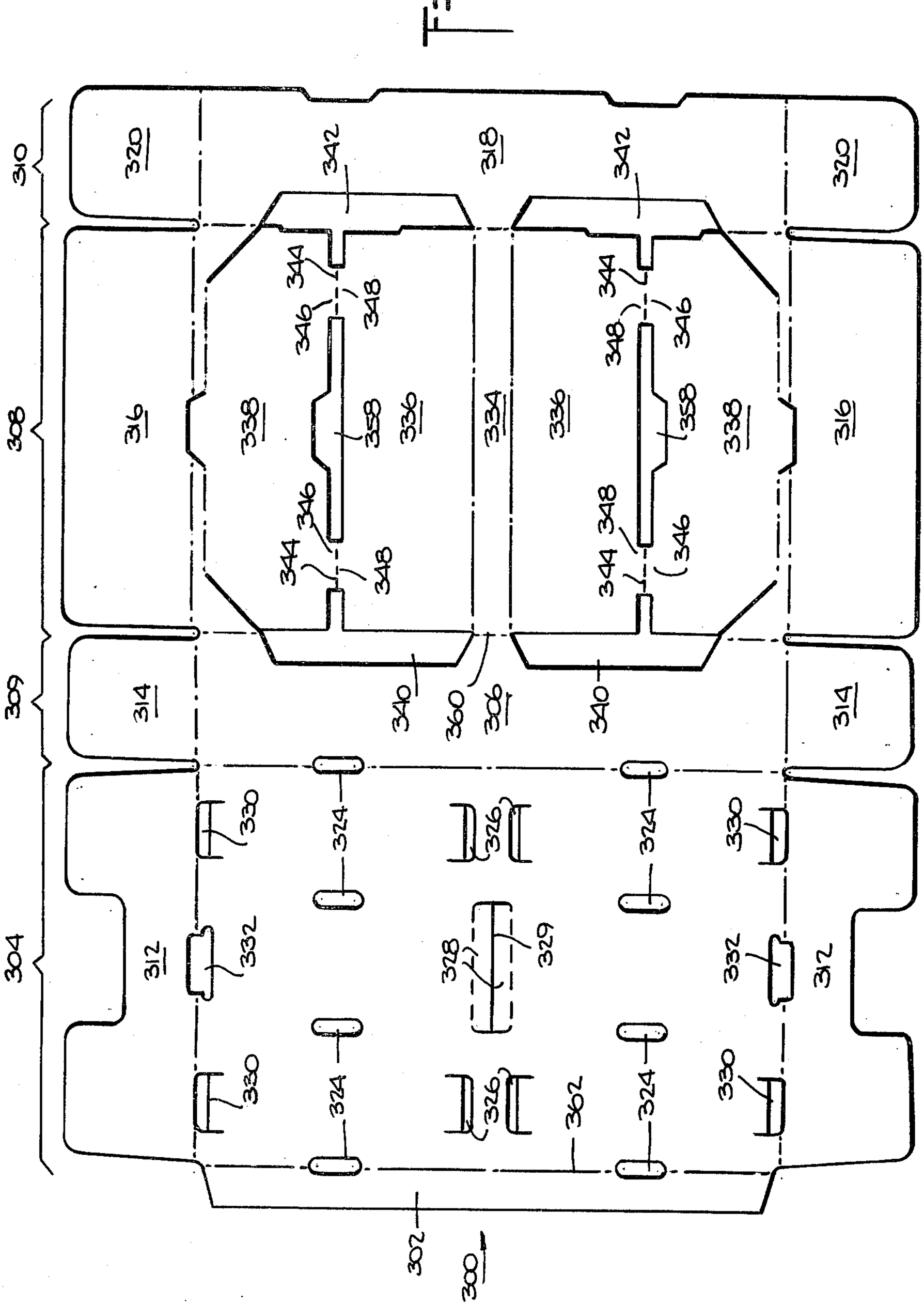
Fig. 5.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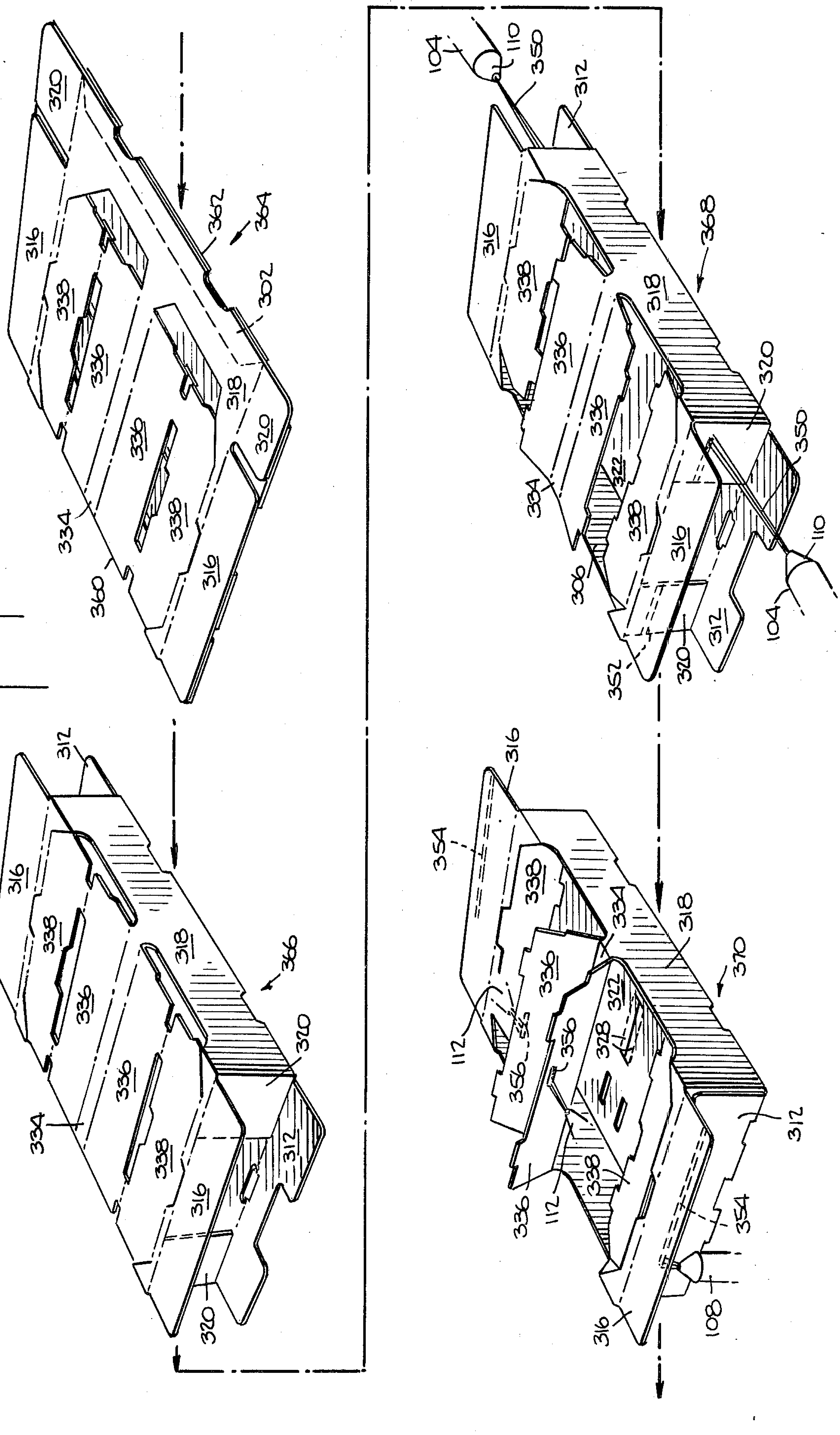

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Fig. 6A.

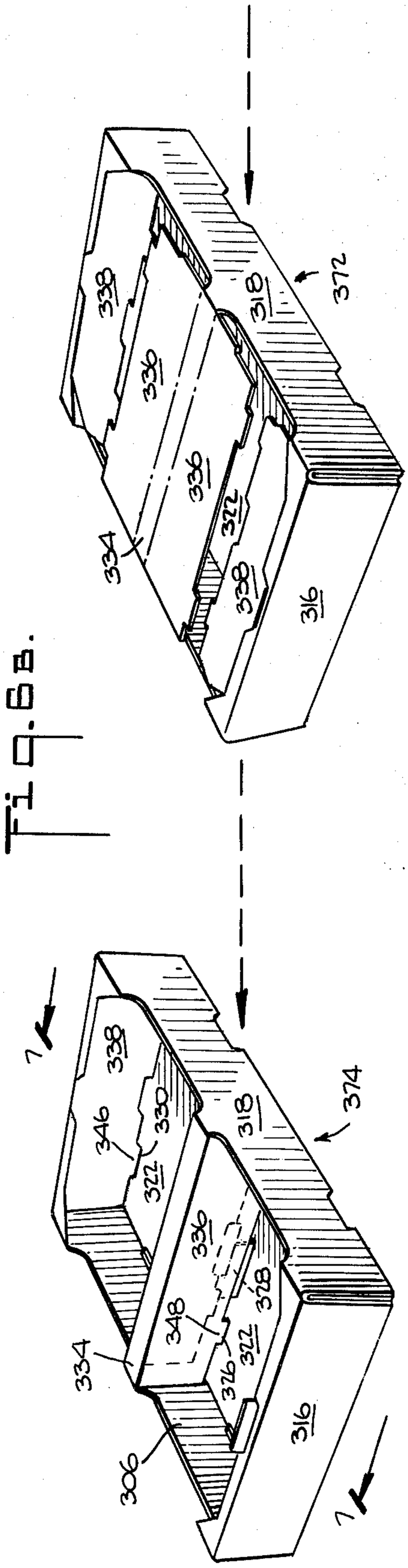
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Fig. 6B.

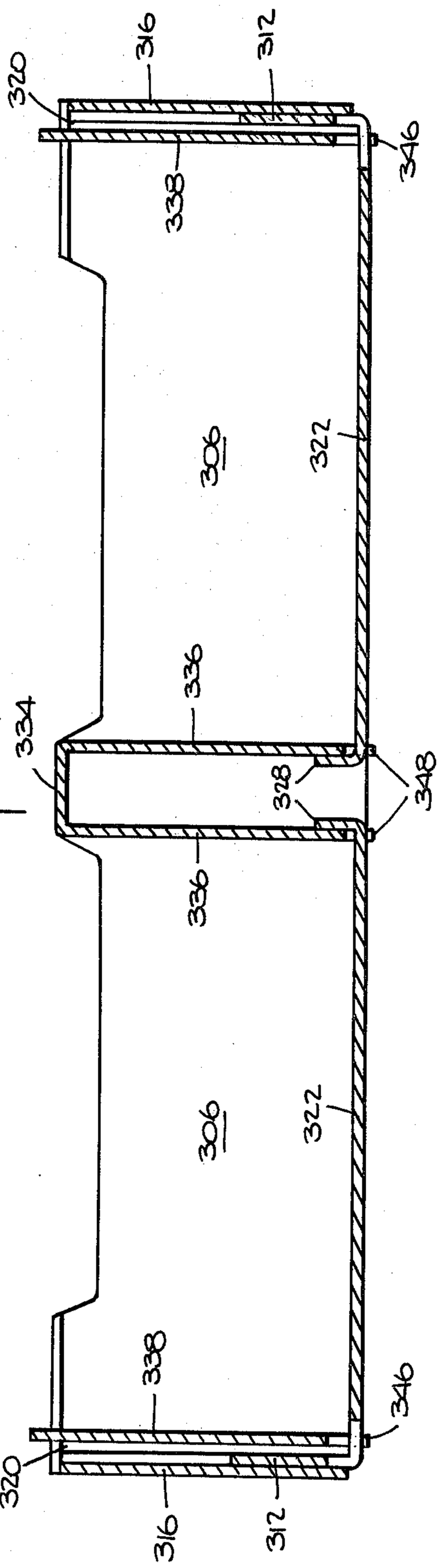
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Fig. 7.

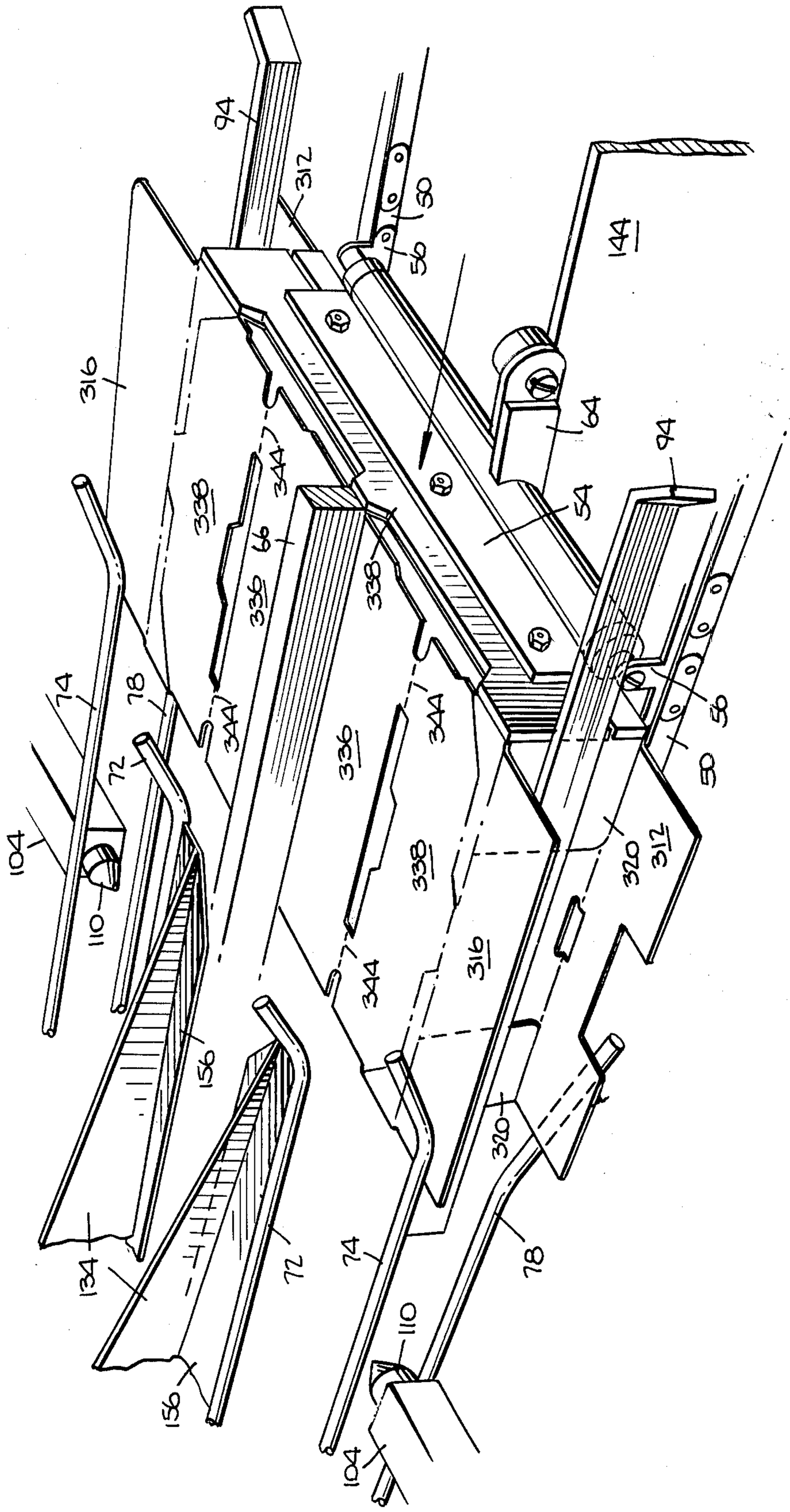
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Fig. 8.

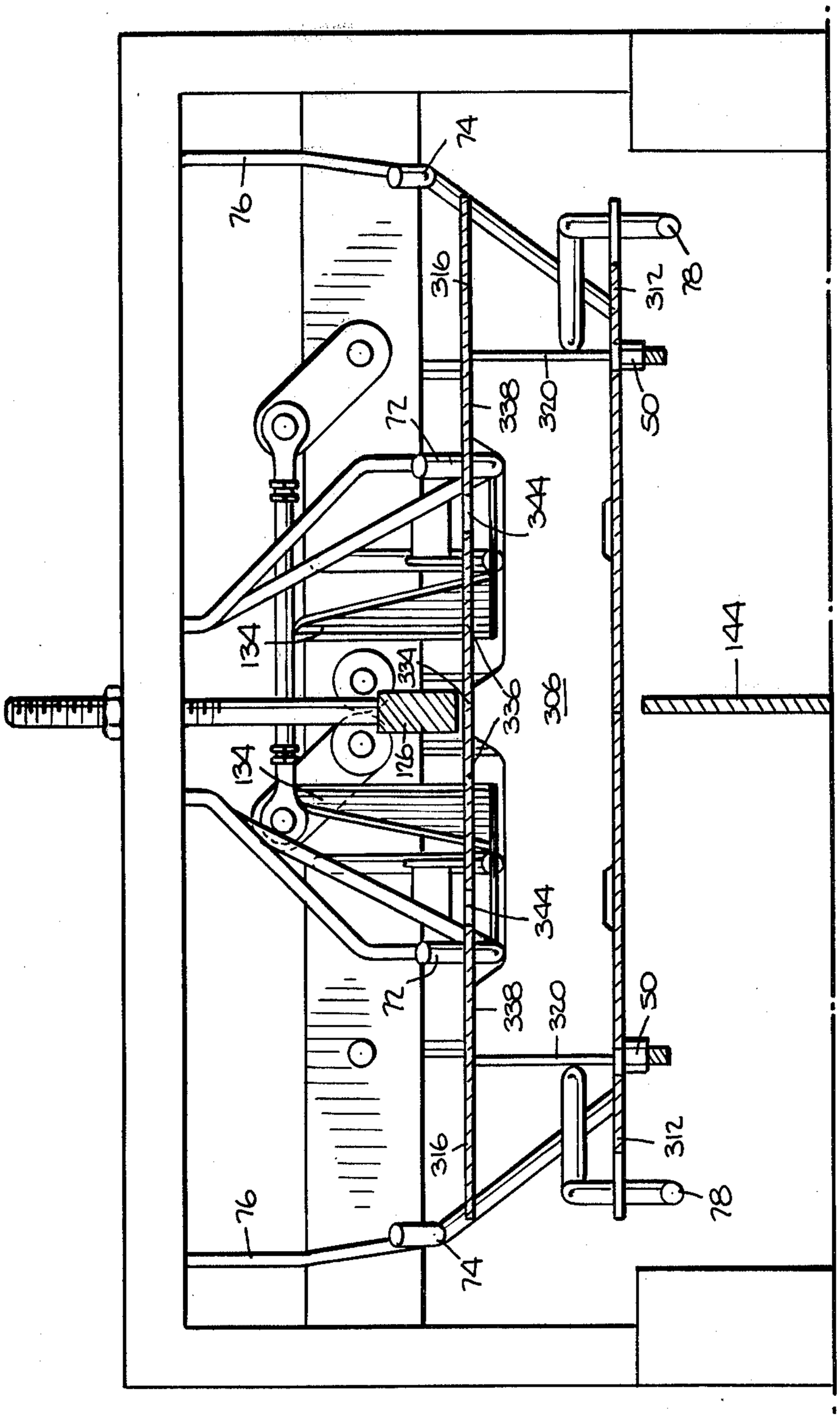

Fig. 9.

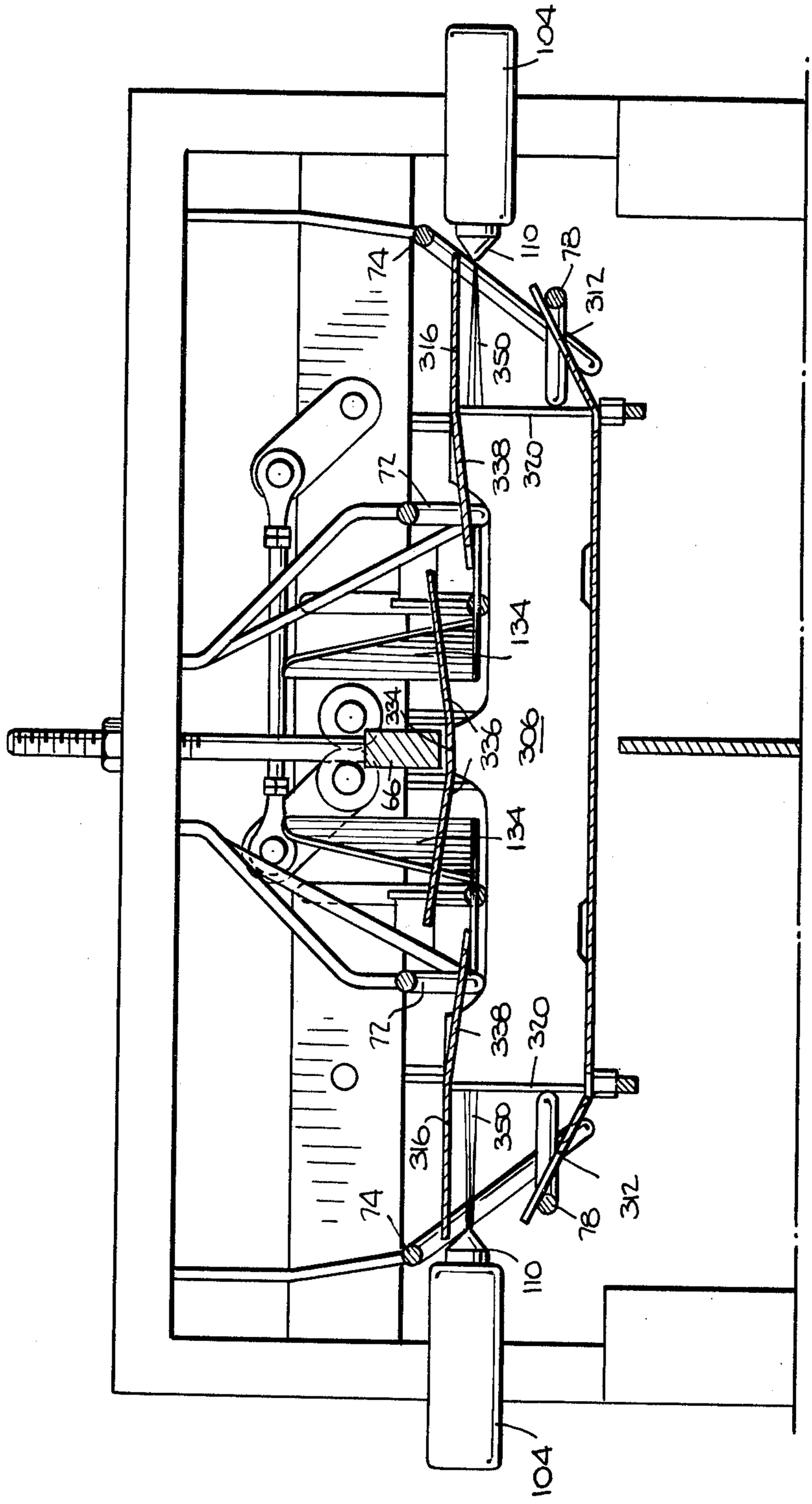
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FIG. 10

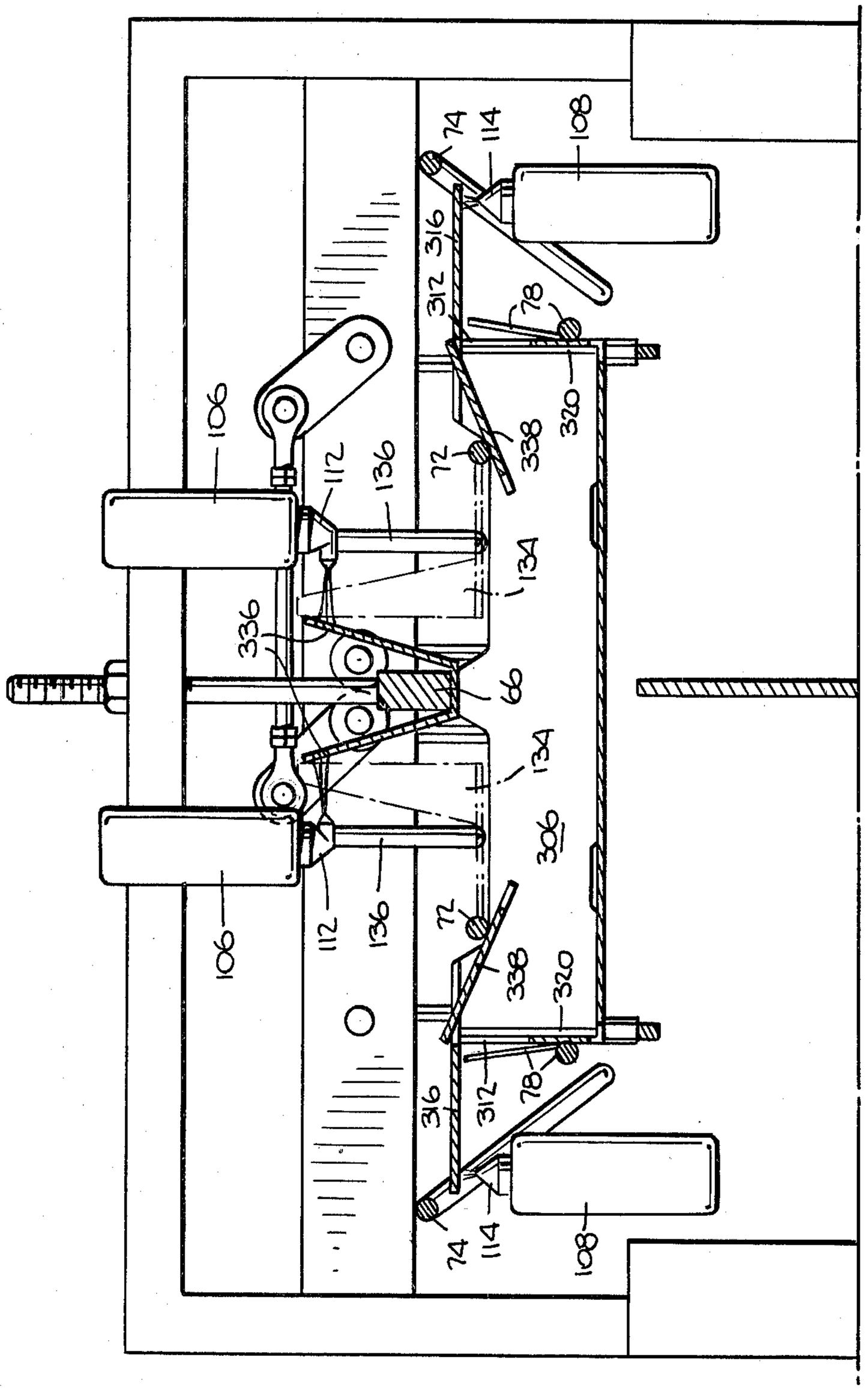

Fig. 11.

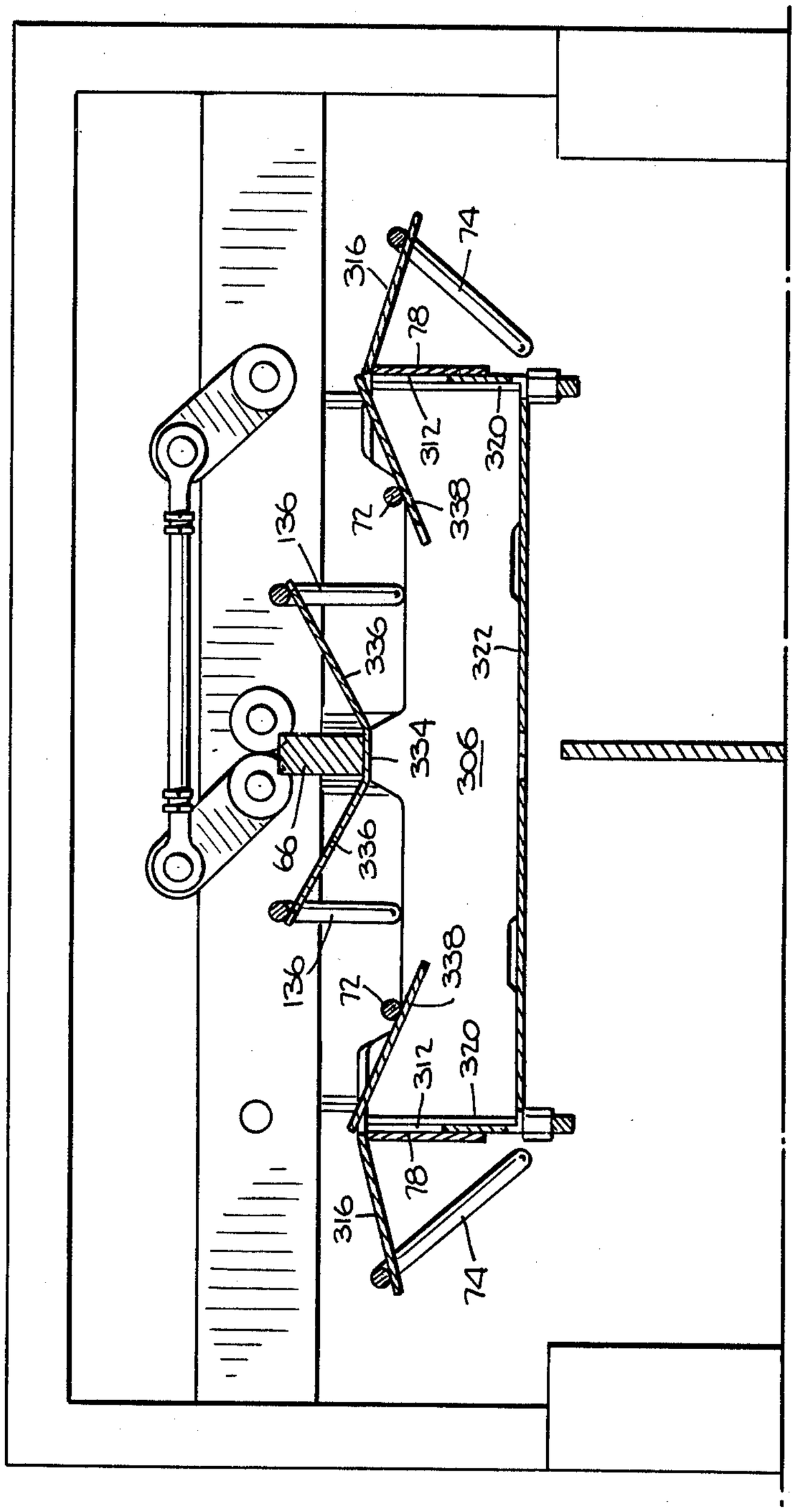
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Fig. 12.

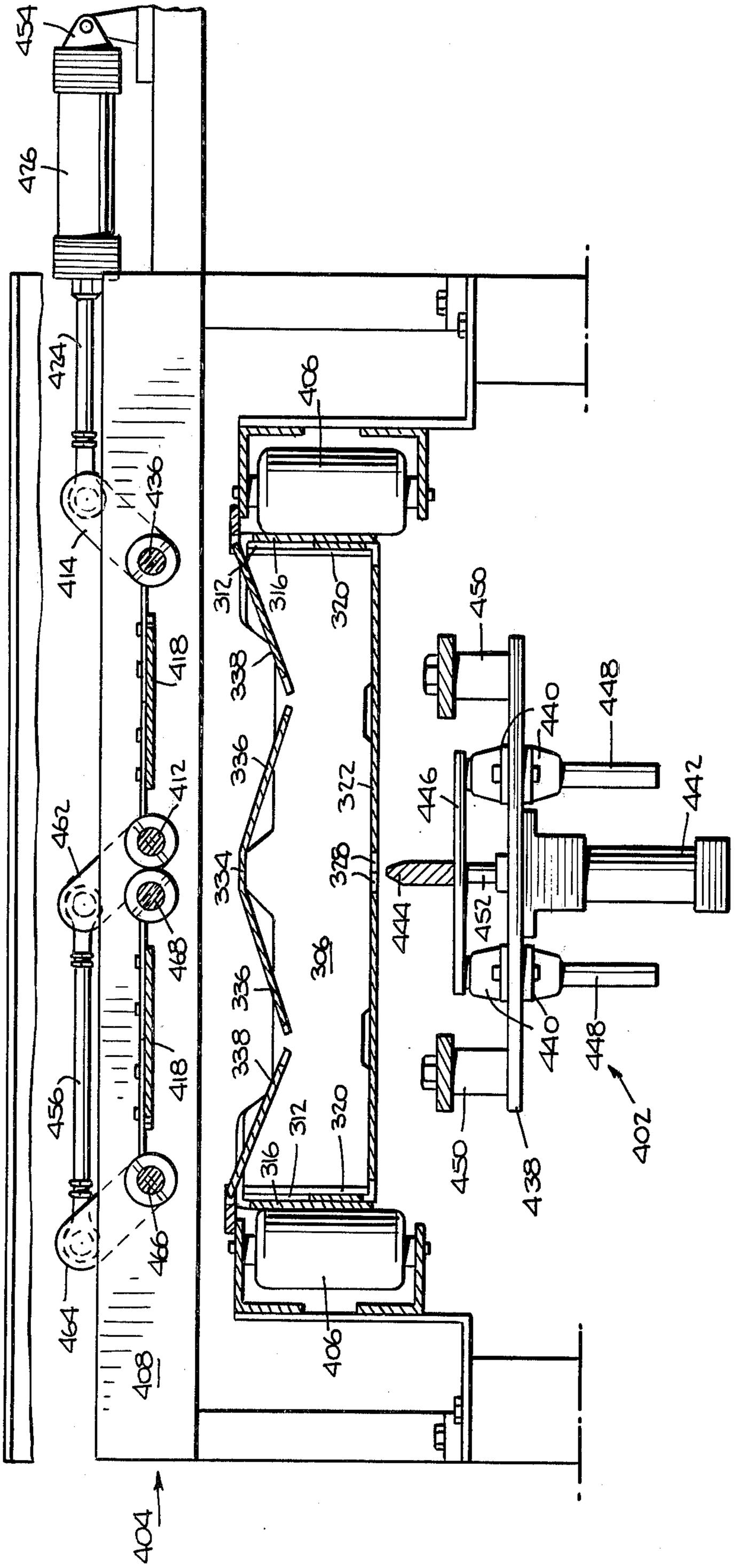
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Fig. 13.

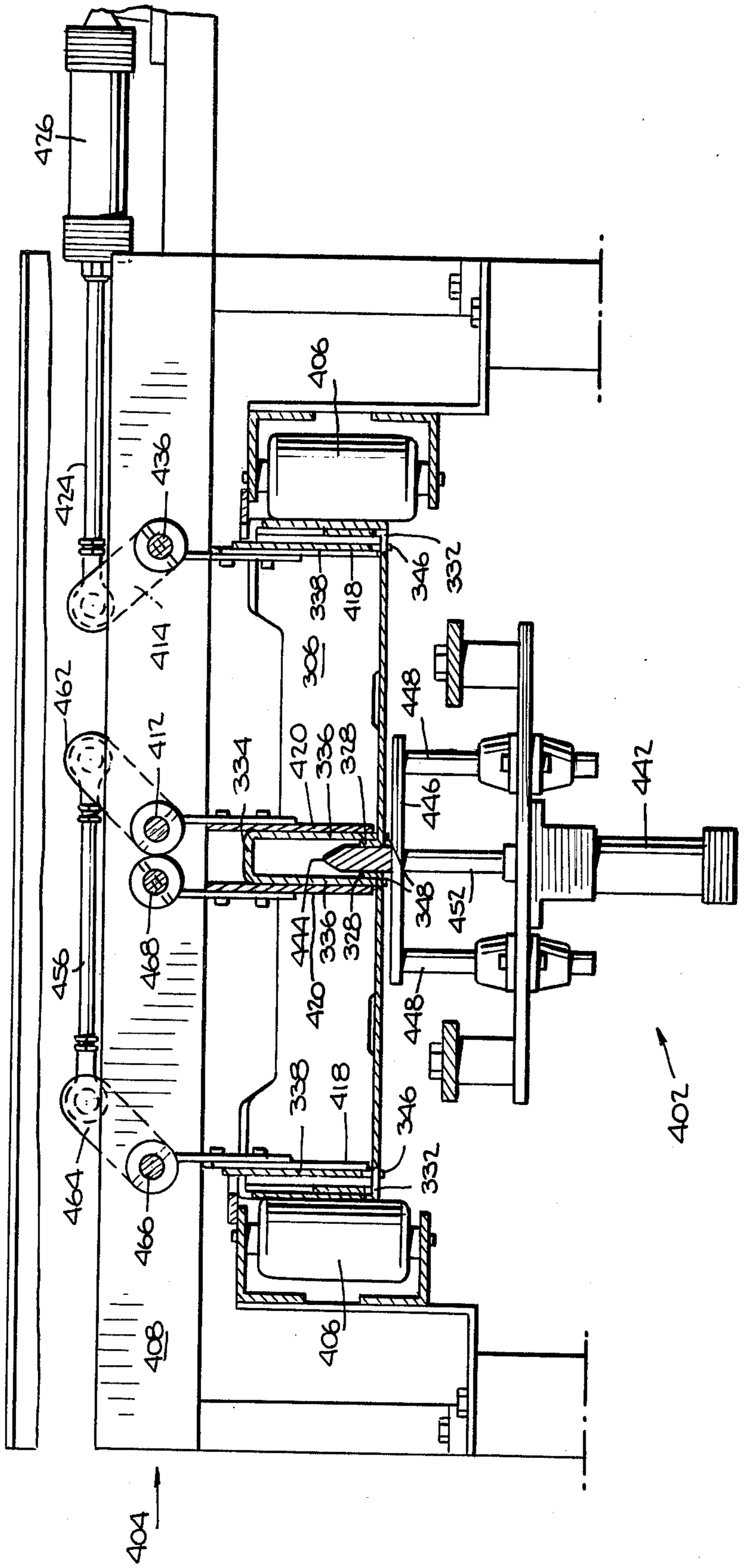
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Fig. 14.

MACHINE FOR ERECTING STRAWBERRY LUG

BACKGROUND OF THE INVENTION

This invention is in the field of boxes and box-folding. More specifically, this invention relates to method and apparatus for erecting a tray having at least one transverse, hollow divider wall formed by two flaps folded downwardly from a transverse bridge into a substantially parallel, spaced relationship, wherein each flap is secured to a tab folded upwards from the bottom of the tray. For convenience, a tray having these features will be referred to as a "strawberry lug." One tray of this type is disclosed in U.S. Pat. application Ser. No. 881,169, filed Feb. 17, 1978, entitled "Shipping Container and Blank Therefor," hereby incorporated by reference.

U.S. Pat. No. 3,965,804 discloses a ram-operated crease-breaker that forces the lower panel of a partially formed tray upwardly into a die. The die is formed by two planes intersecting at an angle and has a U-shaped recess located at the imaginery line of intersection of the two planes. The die is rigidily mounted within a housing that is moved up and down by a second ram. The combined action of the two rams (the bottom ram moving the crease-breaker up and the upper ram moving the die down) is to crease and fold the lower panel into two vertical walls, one wall for each of two separate compartments.

U.S. Pat. No. 3,978,744 discloses a tray-forming machine having an expandable mandrel that forces a blank down into a die. While the expandable mandrel is disposed within the partially formed tray inside the die, a pair of pivotally mounted squeezer plates are brought into a substantially vertical position, thereby pushing connecting flaps against outer walls of the tray.

U.S. Pat. No. 2,863,369 discloses a machine for erecting walls of paperboard containers. A vertical reciprocating member is hingedly connected to several pairs of rigid link members, and the other end of each link is pivotally connected to one of several folding plates that are hingedly connected to the frame of the machine. Downward movement of the vertical member causes the folding plates to rotate downwardly from a horizontal to a vertical position, thereby folding down cross-partition and inner end wall panels.

U.S. Pat. No. 4,034,656 discloses a mandrel in a partition-straightening station of a box-forming machine, said mandrel having a plurality of downwardly pointing cones mounted on a support plate. Between each cone and the support plate is a die having the desired shape of its respective tray cell. Downward movement of the mandrel forces each cone and then its associated die between the partition walls, thereby aligning the walls of that cell.

SUMMARY OF THE INVENTION

Broadly, the present invention relates to method and apparatus for forming a strawberry lug. To erect such a tray, each tab must be folded upwards and held in position while its respective flap is folded downward, to allow securing of the tab to the flap. When glue is the securing means, the tab and flap must be brought into contact for a sufficient length of time to allow proper adhesion of flap to tab before the contacting means are removed. Additionally, the glue should not be visible in the finished tray. Finally, whatever securing means is used, tray erection should be rapid, foolproof, and economical.

These and other objections are achieved by means of apparatus built in accordance with the present invention. One such apparatus is a machine having several forming stations wherein one station comprises tab-folding means for folding the tabs towards the transverse bridge into a substantially parallel, spaced relationship, and flap-folding means for folding the flaps towards the tabs. In a preferred embodiment, the tab-folding means of that station is a reciprocating mandrel (or ram) and the flap-folding means is a pair of rotatably-mounted folding plates, the mandrel and folding plates cooperating in a manner to be described. This station may be said to contain a "folding-ram assembly."

None of the patents discussed above discloses such apparatus, let alone cooperating folding plates and mandrel.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to more fully describe the present invention, the following drawings are provided in which:

FIG. **1** is a partial, side view of a strawberry lug-forming machine, one of whose stations contains a folding-ram assembly;

FIG. **2** is a partial, top view of the machine of FIG. **1**;

FIG. **3** is a partial end view of the machine of FIG. **1**;

FIG. **4** is an enlarged top view of the folding assembly of the folding-ram assembly of FIG. **1**;

FIG. **5** is a plan view of a preferred blank from which a strawberry lug may be formed;

FIG. **6** (**6A** and **6B**) show sequential views of a strawberry lug being erected from the blank of FIG. **5**;

FIG. **7** is a side view of a strawberry lug made from the blank of FIG. **5**, said view taken along line **7**—**7** of the last view in FIG. **6B**;

FIG. **8** shows a squared-up blank of FIG. **5** being fed to the first forming station of the machine of FIG. **1**;

FIGS. **9** to **12** are partial end views showing the squared-up blank of FIG. **8** passing through the forming stations of the machine of FIG. **1** before reaching the folding-ram assembly; and

FIGS. **13** and **14** are partial end views showing the partially erected lug in the final forming station, which contains the folding-ram assembly.

These drawings are for illustrative purposes only and should not be construed to limit the scope of the invention.

DETAILED DESCRIPTION OF THE INVENTION

This invention relates to method and apparatus for erecting a strawberry lug, and, in particular, for erecting the one or more hollow divider wall(s) of the tray. Such trays may be used for transporting produce, such as, strawberries, in small baskets. Several of these trays may be stacked within a box for shipping.

These trays may be made from paper products, e.g., paperboard, or from other materials capable of holding the desired tray shape and having satisfactory physical properties, for example, tensile strength. The tray may be of any size, but generally is from 14 to 24 inches long, 8 to 16 inches wide, and 2.5 to 6 inches deep and has the configuration shown in FIG. **6B** (view **374**).

Blanks for a strawberry lug may be made by machine or hand, preferably by machine. Such blanks may be pre-printed, pre-folded, and stored until needed.

One embodiment of the present invention is shown in the drawings, which embodiment is a lug-erecting machine having a folding-ram assembly for forming the hollow divider wall of the lug.

For clarity, certain obvious elements have been omitted in the drawings. For example, the control panel, electrical wiring, pneumatic lines, most of the air supply system, the glue unit, tubing connecting the glue unit to the glue guns, the exit pusher assembly (which ejects the formed strawberry lug from the machine, over a waterfall, and onto the outfall tracks), and the outfall tracks are not shown. The construction, placement, and functioning of these and the other missing items will be obvious to one skilled in the art. Additionally, again for the sake of clarity, certain elements shown in one figure may not be shown in the other figures.

Turning now to the drawings, FIGS. **1**, **2**, and **3** are, respectively, partial side, top, and end views of machine **20**, which erects the strawberry lug. Not shown in FIGS. **1** or **3** are emergency stop button **128** or casters **122**.

Machine **20** comprises lower frame **22** and upper frame **142**. The folding-ram station, indicated by reference numeral **400**, is located at the left of FIGS. **1** and **2**. A partially pre-folded blank is placed by an operator between infeed flap guides **94** (at the right of FIGS. **1** and **2**), and the blank is pushed through all of the forming stations except the last (the folding-ram station) by one of six flight bars **54**, which are attached to the two roller chains **50** by chain attachment links **56**. (Six flight bars **54** are shown attached to roller chains **50**; however, more or less may be used, depending primarily on the width of the lug.)

Motor **24**, acting through torque limited **26**, rotates sprocket wheel **28** in a counter-clockwise direction in FIG. **1**. Roller chain **40** transmits this counter-clockwise motion to sprocket wheel **30** and, thus, to large sprocket wheels **38** (sprocket wheels **30** and **38** are rigidly mounted on shaft **32**, which is itself rotatably mounted in bearings **34**). Movement of sprocket wheels **38**, in turn, causes counter-clockwise movement of roller chains **50**, which ride on sprocket wheels **38**, **44**, and **46**. Sprocket wheels **44** are rotatably mounted on idler arms **42** or outriggers **48**, and sprocket wheels **46** are rigidly attached to shaft **36**, rotatably mounted in bearings **35**.

Flight bar aligners **64** are attached to flight bars **54** and ride on frame center panel **144** to maintain proper orientation of the flight bars (see, also, FIG. **8**). Flap-scoring mandrel **66** is attached to upper frame **142** by support bars **140**. Mandrel extension **126**, shown only in FIG. **1**, is attached to mandrel **66**. A portion of air supply system **58** is shown at the left of FIG. **1**.

To fold the flaps of the blank, various plowbars, rods, and plates are provided. Inner flap scoring plows **72** are attached to inner flap plowbars **134** by support plates **156** and are attached to upper frame **142** by forward supports **148** and rear supports **146**. Plowrod hangers **76** connect top flap plowrods **74** to upper frame **142**. Outside flap plowbars **78** are connected to lower frame **22** by rear, middle, and forward support bars **158**, **160**, and **162**, respectively, and top support brackets **70**. Plowbars **78** are, for most of their length, rod-shaped, but become bar-shaped at one end. This is most easily seen in FIG. **1**. Inner flap plowrods **136** are connected to supports **149**, which are attached to supports **147**, which, in turn, are carried by supports **146**.

Three pairs of glue guns apply glue to the lug as it is erected. Forward glue guns **104**, having nozzles **110**, are attached to lower frame **22** by mounting plate **88** and mounting supports **90**. Internal glue guns **106**, having nozzles **112**, are attached to upper frame **142** by mounting plate **82** and supports **84**. Rear glue guns **108**, having nozzles **114**, are attached to lower frame **22** by mounting plates **86** and supports **92**.

Three photoelectric cells, only two of which are shown, are used for control purposes. When the blank breaks a beam of light associated with a particular photocell, one or more machine functions are activated. Photocell assembly **100** (including a light source, a photoelectric cell, and a function circuit card) is attached to upper frame **142** by mounting plate **98**. The reflector for this photocell assembly is mounted on frame **22** below the assembly but is not shown in the drawings. Rear photocell assembly **132** is attached to upper frame **142** by mounting plate **130**. Reflector **120**, associated with photocell assembly **132**, is attached to lower frame **22** by bracket **118**.

The locations of forward and rear glue shields **152** and **154**, respectively, are shown in dotted lines. In FIG. **2**, the normal location of glue unit **102**, which rests upon support bars **138**, is shown in dotted lines. The location of the control panel **116** is also shown in dotted lines.

Other support elements shown are supports **96**, connecting infeed flap guides **94** to upper frame **142**, and top support base bars **68**, to which top support brackets **70** are attached. Bars **68** sit above and are attached to flap-scoring mandrel **66**. Air valves/mufflers **150** are also shown in FIG. **1**.

Finally, in FIG. **3** several parts of folding-ram assembly **400** are shown. Cranks **458** and **460** are rotatably mounted in frame **408** on shafts **436** and **468**, respectively, and are connected to one another by forward ocnnecting rod **422**. Outer and inner folding plates **418** and **420**, respectively are shown in their normal position, that is, folded down.

FIG. **4** is a top view of folding assembly **404** of folding-ram station **400**. Center shafts (jackshafts) **412** and **468** are rotatably mounted within frame **408** and are functionally connected by meshed Boston gears **428**. Outer shafts **436** and **466** are also rotatably mounted within frame **408**. Four pairs of folding arms **410** connect outer folding plates **418** to outer shafts **436** and **466** and connect inner folding plates **420** to center shafts **412** and **468**.

Crank **458** is rigidly attached to outer shaft **436** and rotatably connected to forward connected rod **412** through bearing **430** and bolt **432**. Spacer **434** separates the crank handle from the bearing. The other end of rod **422** is rotatably connected to center shaft **468** by a similar bearing, bolt, and spacer arrangement.

Rotation of center shaft **468** causes counter-rotation of center shaft **412** through meshed gears **428**. Shaft **412** carries crank **462**, which, in turn, is rotatably connected to rear connecting rod **456** by bolt **432** and bearing **430**, separated by spacer **434**. The other end of rod **456** is rotatably connected to crank **464** by a similar bolt, bearing, and spacer arrangement. Crank **464** is rigidly mounted on shaft **466**.

Air cylinder **426** is pivotally connected to mounting plate **416** by means of clevis **454**. Air cylinder **426**, which is double air-actuated, normally keeps driveshaft **424** extended from the cylinder. Driveshaft **424** is rotatably connected to crank **414** by bolt **432** and bearing **430**, with spacer **434** in between. The strawberry lug

travels through folding-ram station **400** between rollers **406**, only one of which is labeled.

FIG. **5** is a plan view of a preferred blank **300**, from which a strawberry lug may be erected. Blank bottom assembly **304** comprises bottom end flaps **312** and bottom wall panel **322**. Glue flap **302** lies to the left of bottom wall panel **322**. Blank bottom assembly **304** contains ventilation holes **324**, center tab holes **326**, and tab holes **330**, tab holes **332**, and center tabs **328**, separated by cut-score line **329**.

Blank top assembly **308** comprises top end flaps **316**, transverse bridge panel **334**, center wall panel flaps **336**, and inner end panel flaps **338**. Cut-score lines **344** lie between each pair of inner end panel tabs **346** and center wall panel tabs **348**.

Side wall assembly **309** comprises side end flaps **314** and side wall panels **306**. Side wall assembly **310** comprises side end flaps **320** and side wall panel **318**. Also shown are cut-outs **340**, **341**, and **358**.

Dashed lines in the drawing indicated score lines in the blank along which folding will occur.

Before this blank can be erected by the machine of FIG. **1**, the blank is folded along major score lines **360** and **362**, and flap **302** is glued to side wall panel **318**. The configuration of the blank following this step is shown as view **364** in FIG. **6A**. The blank is then "squared up," that is, transversely compressed so that side wall panels **318** and **306** become perpendicular to top and bottom assemblies **308** and **304**. Additionally, the trailing pair (and, optionally, the leading pair) of side end flaps **320** are folded inwardly, as shown in view **366** of FIG. **6A**, where both pairs of flaps **320** have been folded. (By "leading" or "trailing" is meant, respectively, closer to, or farther from, the discharge end of the machine, to the left in FIG. **1**.)

As will be appreciated, because the blank in view **366** occupies more space than in view **364**, the blank is usually transported to the machine of FIG. **1** while flattened (view **364**). The blank is then squared-up, one or both pairs of side end flaps **320** are folded inwardly (view **366**), the blank is placed on roller chains **50** between infeed flap guides **94**, and the next available flight bar **54** starts the movement of the blank through the machine.

View **368** of FIG. **6A** shows center wall panel flaps **336** separated from inner end panel flaps **338**. The center wall panel flaps have been moved up, away from bottom wall panel **322**, and the inner end panel flaps have been rotated downwardly, towards panel **322**. Additionally, glue **350** is being shot from glue guns **104** and nozzles **110** onto side end flaps **320** to form glue lines **352** (only one of which is shown).

In view **370**, bottom end flaps **312** have been folded upwardly to contact and adhere to side end flaps **320**. Glue is being shot from internal glue gun nozzles **112** to form glue lines **356** on center wall panel flaps **336**, which have been rotated upwardly. Glue lines **354** are being formed on the underside of top end flaps **316** by glue shot from rear glue guns **108** (only one of which is shown).

View **372** of FIG. **6B** shows top end flaps **316** rotated downwardly to contact and adhere to bottom end flaps **312**. Also, center wall panel flaps **336** have been rotated downwardly, to a plane approximately parallel to bottom wall panel **322**.

The finished strawberry lug is shown in view **374**. Center wall panel flaps **336** have been folded downwardly so that they are substantially parallel to one another and are separated by transverse bridge panel **334**. Center wall panel tabs **348** have been inserted into center tab holes **326**, and center tabs **328** have been folded upwardly into a substantially parallel spaced relationship. Each center tab **328** is attached to its respective center wall panel flap **336** by glue line **356**. Also, inner end panel flaps **338** have been folded downwardly so that they are substantially perpendicular to bottom wall panel **322**, and are held in place by inner end panel tabs **346**, which are inserted into end tab holes **330**.

FIG. **7** is a cross-sectional view of view **374** of FIG. **6B**, taken along line **7—7**, and shows inner end panel flaps **338** lying next to side end flaps **320**. Bottom end flaps **312** lie between top end flaps **316** and side end flaps **320**. Center wall panel flaps **336** are substantially parallel to one another and are adhered to center tabs **328**. The ends of inner end panel tabs **346** and of center wall panel tabs **348** project below bottom wall panel **322**.

FIG. **8** shows the blank of view **366** having just been fed to the machine of FIG. **1** for erection. The blank rides on roller chains **50** and is being pushed by flight bar **54**, which is connected to roller chains **50** by chain attachment links **56**. Flight bar aligner **64** rides on frame center panel **144** to maintain flight bar **54** in the proper orientation with respect to the blank.

As the blank moves in the machine direction (from right to left, as indicated by the arrow), bottom end flap **312** will be moved upwardly by outside flap plowbars **78**, and top end flaps **316** will be rotated downwardly by top flap plowrods **74**. Glue will be shot from glue guns **104** through nozzles **110** onto side end flaps **320**. Center wall panel flaps **336** will be rotated upwardly by inner flap plowbars **134**, and inner end panel flaps **338** will be rotated downwardly by inner flap scoring plows **72**, thereby separating center wall panel flaps **336** from inner end panel flaps **338** at cut-score lines **344**.

FIGS. **9** to **14** are partial end views of the machine of FIG. **1**, looking along the machine direction. Many elements are omitted from these drawings so that the co-action of the machine and blank during lug erection may be more clearly seen. Additionally, for clarity, only a sectional view of the blank, taken along line **7—7** of FIG. **6B** is shown in these drawings. FIG. **9** is a sectional end view of FIG. **8** (note that infeed flap guides **94** and glue guns **104** are not shown).

FIG. **10** shows the blank moved farther along the machine. Top end flap **316** and bottom end flap **312** have broken the light beam associated with photocell **100** (FIGS. **1** and **2**), and this, in turn, has caused glue guns **104** to shoot glue **350** at side end flaps **320**. Additionally, bottom end flaps **312** have been brought into contact with outside flap plowbars **78**, causing those flaps to rotate upwardly. The leading edges of center wall panel flaps **336** have been pushed against inner flap plowbars **134**, and inner end panel flaps **338** have been pushed against inner flap scoring plows **72**. This has separated center wall panel flaps **336** from inner end panel flaps **338** along cut-score lines **344**, upwardly rotated the former, and downwardly rotated the latter.

In FIG. **11**, the blank has progressed sufficiently through the machine so that bottom end flaps **312** have contacted the end, bar portions of outside flap plowbars **78**, causing bottom end flaps **312** to contact the glue previously applied to the outside of side end flaps **320**. At this point, left top end flap **316** is no longer breaking the beam of light associated with photocell **100**. This has caused rear glue guns **108** to apply glue to the un-

derside of top end flaps **316** and internal glue guns **106** to apply glue to center wall panel flaps **336**. The trailing portions of center wall panel flaps **336** are still contacting inner flap plowbars **134** (shown in dotted lines), thus holding center wall panel flaps **336** sufficiently upright for application of the glue. Inner end panel flaps **338** are still being depressed by inner flap scoring plows **72**.

FIG. **12** shows the blank at a point where top end flaps **316** are being forced against top flap plowrods **74**, causing the flaps to rotate downwardly. The bar portions of outside flap plowbars **78** are still contacting bottom end flaps **312**. Inner end panel flaps **338** are still being depressed by inner flap scoring plows **72**, and transverse bridge panel **334** is lying against flap-scoring mandrel **66**. Center wall panel flaps **336** are contacting inner flap plowrods **136**, thereby downwardly rotating flaps **336**, which no longer contact inner flap plowbars **134** as in FIG. **11**.

Further progression of the blank through the machine causes flaps **316** to contact, and thereby adhere to, bottom end flaps **312**, and causes inner flap plowrods to rotate center wall panel flaps **336** downwardly to point towards bottom wall panel **322**. Additionally, the leading edge of the blank interrupts the beam of light associated with photocell assembly **132** (see FIG. **2**), causing air cylinder **426** (FIG. **13**) to pressurize so as to retract driveshaft **424**. This retraction pressurization ultimately causes outer folding plates **418** and inner folding plates **420** to rotate upwardly into a horizontal position, as will be explained below. Flight bar **54** continues to push the blank until the latter has entered the folding-ram station. (Because of reliability, it is preferred that air cylinders **426** and **442** be double air-actuated; however, either could be single air-actuated and contain biasing means, e.g., a spring, to keep its piston normally extended or retracted. Furthermore, solenoids or other reciprocating means could be used instead of air cylinders.)

Referring to FIGS. **4** and **13**, retraction of driveshaft **424** causes cranks **414** and **458** and shaft **436**, on which both cranks are rigidly mounted, to rotate clockwise. (In discussing operation of the folding-ram assembly, the directions "clockwise," "counter-clockwise," "right," and "left" are with reference to FIG. **13**.) This moves forward connecting rod **422** to the right (in the same direction as driveshaft **424** moves when it retracts), causing clockwise rotation of left center shaft **468**.

Because of the interconnection of center shafts **468** and **412** by meshed gears **428**, clockwise rotation of shaft **468** results in counter-clockwise rotation of shaft **412**. Crank **462** then rotates in a counter-clockwise fashion and pushes rear connecting rod **456** to the left (away from the air cylinder), which causes counter-clockwise rotation of crank **464** and left outer shaft **466**. The four folding plates, attached to shafts **436**, **412**, **468**, and **466**, are, thus, moved to the horizontal by retraction of driveshaft **424**. Extension pressurization of air cylinder **426** causes the reverse of the movements described, resulting in downward rotation of the folding plates to the vertical. Note that clevis **454**, attached to one end of air cylinder **426**, allows the other end and driveshaft **424** to move up and down with respect to the frame. Such up and down movement occurs as the folding plates go from the vertical to the horizontal, and vice versa, because the bolt connecting driveshaft **424** to crank **414** follows an arcuate path. Movement of the folding plates to the horizontal allows the partially-erected strawberry lug to be pushed into the folding-ram station by the flight bar.

FIG. **13** shows the blank within the folding-ram station, the final station of the machine. Ram assembly **402** lies below the blank. Flanges **440** and stand-offs **450** are attached to plate **438**, which is connected to lower frame **22**. Mandrel **444** is attached to mandrel mount **446**, which is connected to air cylinder shaft **452** and rods **448**. Air cylinder shaft **452** moves within mandrel air cylinder **442** (double air-activated), and rods **448** move up and down within flanges **440**. Standoffs **450** help gauge the spacing between the tip of mandrel **444** and the bottom of the blank. When mandrel **444** is fully retracted, such spacing is preferably from 0.25 to 0.50 inches. Also, the centerline of mandrel **444** preferably lies in the same vertical plane as the cut-score line between center tabs **328**.

In FIG. **13**, inner end panel flaps **338** and center wall panel flaps **336** are all inclined towards bottom wall panel **322**. The blank is no longer carried by roller chains **50** or pushed by flight bar **54**, and instead, the blank rides between rollers **406**. Center tabs **328** are positioned directly above mandrel **444**, which is retracted.

When the blank has completely entered the forming station, it no longer breaks the beam of light associated with photocell assembly **132** and reflector **120** (FIG. **14**). This results in extension pressurization of mandrel air cylinder **442**, which forces mandrel **444** upwardly, and in extension pressurization of air cylinder **426**, which forces driveshaft **424** outwardly, causing all four folding plates to rotate downwardly.

Downward movement of outer folding plates **418** rotates flaps **338** downwardly and forces inner end panel tabs **346** into end tab holes **330**. Downward movement of inner folding plates **420** rotates flaps **336** downwardly and forces center wall panel tabs **348** into center tab holes **326**. The ends of tabs **346** and **348** project below the bottom of the strawberry lug. At the same time, upward movement of mandrel **444** pushes center tabs **328** from a horizontal to a vertical position.

The combined effect of the upward movement of mandrel **444** and downward rotation of inner folding plates **420** is to force each center wall panel flap **336** against its respective center tab **328**. Glue previously applied to each flap **336** (see FIG. **11**) secures the flap to the center tab it contacts.

In the finished strawberry lug, center wall panel flaps **336** are in a substantially parallel, spaced relationship, each secured to its respective upwardly folded center tab **328** and separated by transverse bridge panel **334**. The hollow wall thus formed imparts greater strength and rigidity to the strawberry lug.

The leading edge of the next blank carried by roller chains **50** towards the folding-ram station interrupts the beam of light reflected from reflector **120** to photocell assembly **132**. As explained above, this causes retraction pressurization of air cylinder **426**, which, in turn, causes inner and outer folding plates **420** and **418** to return to the horizontal. Interruption of the light beam also causes retraction pressurization of mandrel air cylinder **442**, which lowers mandrel **444** to the position shown in FIG. **13**. Finally, movement of the next blank into the folding-ram station forces the strawberry lug just formed to move out of the station. The leading edge of the formed lug then breaks a light beam associated with a third photocell assembly (not shown). This activates a pusher assembly (not shown) to force the finished

strawberry lug over a waterfall (not shown), from which it falls onto a stack of previously erected lugs.

As will be obvious to one skilled in the art, many modifications and variations in the present invention can be made. The claims are intended to cover all such modifications and variations.

I claim:

1. In a machine for erecting a shipping container tray from a blank, said tray having at least one hollow divider wall formed by (a) a transverse bridge, (b) first and second flaps hingedly connected to and downwardly extending from the transverse bridge, and (c) first and second tabs hingedly connected to and upwardly extending from the bottom of the tray, the first flap being secured by securing means to the first tab and the second flap being secured by securing means to the second tab, apparatus for forming the wall, comprising:

(a) means for folding the tabs towards the bridge into a substantially parallel, spaced relationship wherein the tabs are substantially perpendicular to the portion of the blank that forms the tray bottom; and

(b) means for folding the flaps towards the tabs into a substantially parallel, spaced relationship wherein each flap contacts its respective tab.

2. The apparatus of claim **1** wherein the means for folding the tabs towards the transverse bridge comprises a reciprocating mandrel.

3. The apparatus of claim **1** wherein the means for folding the flaps towards the tabs comprises a pair of rotatably-mounted folding plates.

4. The apparatus of claim **1** further comprising means to apply the securing means to each flap-tab pair.

5. The apparatus of claim **4** wherein a glue gun is used to apply glue to secure each flap to its respective tab.

6. In a machine for erecting a shipping container tray from a blank, said tray having at least one hollow divider wall formed by (a) a transverse bridge, (b) first and second flaps hingedly connected to and downwardly extending from the transverse bridge, and (c) first and second tabs hingedly connected to and upwardly extending from the bottom of the tray, the first flap being secured by securing means to the first tab and the second flap being secured by securing means to the second tab, apparatus for forming the wall, comprising:

(a) first and second rotatably-mounted folding plates;

(b) a reciprocating mandrel movable in a direction substantially perpendicular to the portion of the blank that forms the bottom of the erected tray;

(c) means for positioning the blank so that the first flap is under the first folding plate, the second flap is under the second folding plate, and the mandrel is under the first and second tabs;

(d) means for causing the mandrel to move upward to fold the tabs upward into a substantially parallel, spaced relationship wherein the tabs are substantially perpendicular to the portion of the blank that forms the tray bottom;

(e) means for causing the plates to rotate downward to fold the flaps downward into a substantially parallel, spaced relationship wherein each flap contacts its respective tab;

(f) means for retracting the mandrel after each flap is secured to its respective tab; and

(g) means for upwardly rotating the folding plates after each flap is secured to its respective tab.

7. The apparatus of claim **6** further comprising means to apply the securing means to each flap-tab pair.

8. The apparatus of claim **7** wherein a glue gun is used to apply glue to secure each flap to its respective tab.

9. The apparatus of claim **6** further comprising means to remove the tray from under the folding plates.

10. The apparatus of claim **6** further comprising first and second air cylinders wherein (a) the mandrel is connected to the first air cylinder, extension pressurization of which causes the mandrel to move upward; and (b) the folding plates are connected to the second air cylinder, retraction pressurization of which causes the plates to rotate upward.

11. In a machine for erecting a shipping container tray from a blank, said tray having (a) at least one hollow divider wall formed by **(1)** a transverse bridge, **(2)** first and second divider wall flaps hingedly connected to and downwardly extending from the transverse bridge, and **(3)** first and second tabs hingedly connected to and upwardly extending from the bottom of the tray, the first flap being secured by securing means to the first tab and the second flap being secured by securing means to the second tab; and (b) two end walls substantially parallel to the hollow divider wall and formed in part by first and second inner end flaps, each flap being folded downward from the top of its respective end wall; apparatus comprising:

(a) a frame having a top section and a bottom section;

(b) first and second inner folding plates, rotatably mounted in the top section of the frame;

(c) first and second outer folding plates, rotatably mounted in the top section of the frame;

(d) a first air cylinder, attached to the upper section of the frame and containing a piston connected to a driveshaft, wherein extension pressurization normally keeps the piston and driveshaft in an extended position and retraction pressurization of the air cylinder causes retraction of the piston and driveshaft;

(e) means connecting the driveshaft to the four folding plates so that retraction of the driveshaft causes the plates to rotate to a horizontal position and extension of the driveshaft causes the plates to rotate to the vertical;

(f) a second air cylinder, vertically mounted, attached to the lower section of the frame, and having a piston connected to a mandrel, wherein extension pressurization of the cylinder forces the mandrel up and retraction pressurization causes the mandrel to retract;

(g) means for sensing the approach of a blank to the frame wherein such approach causes retraction pressurization of the first air cylinder and retraction pressurization of the second air cylinder, thereby causing the four folding plates to rotate to the horizontal and causing the mandrel to retract;

(h) means for positioning the blank after the mandrel is retracted and the four folding plates are horizontal so that the first and second inner folding plates are above the first and second divider wall flaps, respectively, the first and second outer folding plates are above the first and second inner end flaps, respectively, and the mandrel is below the first and second tabs;

(i) means for causing extension pressurization of the first air cylinder and extension pressurization of the second air cylinder after the blank is positioned as in (h), thereby forcing the mandrel up to fold the first and second tabs up and moving the four folding plates to the vertical to rotate the four flaps to

the vertical so that each of the first and second divider wall flaps contacts its respective tab, and each of the first and second inner end flaps becomes part of its respective end wall; and

(j) means to apply the securing means to each divider wall flap-tab pair.

12. The apparatus of claim **11** wherein glue is the securing means.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,217,815

DATED : August 19, 1980

INVENTOR(S) : Ulrich G. Nowacki

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

column 1, line 16, change "17" to --27--; line 31, change "3,978,744" to --3,978,774--;
column 2, line 3, change "objections" to --objectives--;
column 3, line 34, change "limited" to --limiter--;
column 4, line 37, change "ocnnecting" to --connecting--; line 50, change "connected rod 412" to --connecting rod 422--; and
column 5, line 19, change "341" to --342--.

Signed and Sealed this

Fourteenth Day of *April 1981*

[SEAL]

Attest:

RENE D. TEGTMEYER

Attesting Officer

Acting Commissioner of Patents and Trademarks